

Revision 1 Summary

October 15, 2003



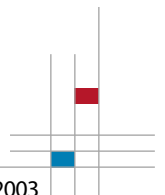
This first revision to *NASA's Implementation Plan for Space Shuttle Return to Flight and Beyond* reflects our progress to date in responding to the recommendations and observations of the *Columbia* Accident Investigation Board (CAIB), as well as additional actions initiated by the Space Shuttle Program. This revision supercedes the first iteration of our return to flight Implementation Plan released on September 8, 2003, and includes formatting that indicates where changes and updates have been made to show progress since the first Plan was released. We have renamed the document to ensure that its focus on Shuttle return to flight activities is clear and to recognize the fact that NASA still has critical programs that are continuing to fly while the Shuttle is grounded, including the International Space Station. In the future we anticipate that other areas of NASA may develop their own implementation plans in response to the CAIB report and other lessons-learned from the *Columbia* accident.

Since the initial release of the Implementation Plan, NASA has made progress in a number of critical areas of planning and implementation. In this revision, NASA has added responses to the observations contained in Chapter 10 of the CAIB Report. These responses are included in Section 2, "Raising the Bar – Other Corrective Actions." Beyond the CAIB observations, NASA continues to receive and evaluate inputs from a variety of sources, including the soon to be released Volume II, Appendix D of the CAIB Report, ideas submitted by our own employees, submittals to our virtual suggestion box at rftfsuggestions@nasa.gov, and suggestions from individual members of the CAIB. We are systematically assessing the proposed corrective actions and will incorporate these actions into future revisions of this Implementation Plan. In addition to our own monitoring of progress, which is reflected in this document, the Return to Flight Task Group will assess NASA's success in implementing return to flight requirements before we commit to flight.

NASA has progressed from planning to implementation in many critical return to flight areas. Several examples of our significant progress are in the areas of External Tank (ET), Thermal Protection System (TPS) repair and inspection, and cultural and organizational issues.

ET Foam Loss Mitigation. NASA completed high-fidelity tests duplicating the foam imperfections that contributed to the ET foam loss on STS-107. The results of these tests will help identify the root cause of foam loss, a fundamental prerequisite for return to safe flight. At the same time, based on our ongoing analysis of mitigation strategies, we deferred further development of containment boots in favor of more effective options. To further reduce the risk of foam loss, NASA completed design and testing of a new hydrogen tank/intertank flange configuration that will reduce the possibility of voids. To improve our ability to detect potential problems, NASA built backscatter x-ray and terahertz imaging prototypes, two alternative methods of advanced nondestructive inspection (NDI) of the ET foam. These two methods provide complementary data and may be used to screen for voids.

Impact Testing. NASA also conducted additional foam impact tests on Reinforced Carbon-Carbon (RCC) panels used on the Shuttle's wings. These foam tests showed no



visible damage, but we will be performing NDI to verify the results. Additional impact tests of varying size and velocity will be performed over the next several months to define the actual structural capability of RCC and tile to withstand impacts from a wide range of debris, including foam, ice, and other material. These tests will help to define which debris is critical and validate improved impact prediction software models.

Thermal Protection System Inspection and Repair. We have also made significant progress in our ability to perform on-orbit tile repair. NASA completed the first series of tests on repaired tile, using arc jets to simulate the heating they will experience on entry. The preliminary results of these tests are promising and will be confirmed using both NDI and destructive evaluations. Proposed EVA processes and tools for on-orbit tile repair have now been tested on KC-135 zero gravity flights. Finally, NASA has begun work necessary to establish on-orbit Shuttle RCC repair procedures; to define Orbiter damage tolerances; and to develop and integrate the Shuttle robotic arm's extension boom and the attached laser/camera sensor package for TPS inspection.

Organization and Culture. The NASA Administrator continues to assess the organization and culture of NASA. A NASA team led by the Associate Administrator chartered a team led by the Associate Administrator for Safety and Mission Assurance to develop options for responding to CAIB recommendations 7.5-1 on the establishment of an Independent Technical Authority and 7.5-2 on safety organization improvements. As a part of this effort, the Space Shuttle Program is working with industry and the Department of Defense to benchmark their independent oversight processes. The Goddard Space Flight Center Director is leading a complementary team to make recommendations on how the CAIB findings and recommendations can be applied beyond the Shuttle Program and across the Agency. Additionally, the core team for the NASA Engineering and Safety Center (NESC) is now in place at the NASA Langley Research Center. They are in the process of hiring the full NESC staff and expect to formally open the Center in November 2003. NASA is taking a number of positive steps to identify cultural obstacles to effective risk management, including seeking suggestions from external experts. We will then make specific and fundamental changes to remove those obstacles with training programs and other management initiatives.

The progress NASA has made has also enabled us to develop a better estimate of when we will be able to return safely to flight. We are now working toward a return to flight date between September 12, 2004, and October 10, 2004. This date will be adjusted further if necessary to allow us to implement our return to flight actions and verify our readiness with the Return to Flight Task Group.

To ensure we have the logistics necessary to support the ISS crew and continued assembly, NASA has added an additional flight to the Shuttle manifest. The new flight, STS-121, will accomplish some of the International Space Station utilization objectives that were removed from STS-114. These tasks were deferred to accommodate critical RTF activities such as demonstrating TPS inspection and repair.

We have accomplished much in the last several months, and there is much more work to be done. The combined efforts of every NASA Center, our contractors, and our other industry and government partners have put us on a path that will allow us to return safely to flight as soon as possible. The ingenuity and dedication of the NASA workforce and the commitment of the nation to the NASA mission will continue to propel us toward our shared goal of safely returning the Shuttle to flight, and safely returning it home.

